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Work disability in the United States, 1968–2015: Prevalence, duration, recovery, and trends

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ABSTRACT

The United States workforce is aging. At the same time more people have chronic conditions, for longer periods. Given these trends the importance of work disability, physical or nervous problems that limit a person's type or amount of work, is increasing. No research has examined transitions among multiple levels of work disability, recovery from work disability, or trends. Limited research has focused on work disability among African Americans and Hispanics, or separately for women and men. We examined these areas using data from 30,563 adults in the 1968–2015 Panel Study of Income Dynamics. We estimated annual probabilities of work disability, recovery, and death with multinomial logistic Markov models. Microsimulations accounting for age and education estimated outcomes for African American, Hispanic, and non-Hispanic white women and men. Results from these nationally representative data suggested that the majority of Americans experience work disability during working life. Most spells ended with recovery or reduced severity. Among women, African Americans and Hispanics had less moderate and severe work disability than whites. Among men, African Americans became severely work disabled more often than whites, recovered from severe spells more often and had shorter severe spells, yet had more severe work disability at age 65. Hispanic men were more likely to report at least one spell of severe work disability than whites; they also had substantially more recovery from severe work disability, and a lower percentage of working years with work disability. Among African Americans and Hispanics, men were considerably more likely than women to have severe work disability at age 65. Work disability declined significantly across the study period for all groups. Although work disability has declined over several decades, it remains common. Results suggest that the majority of work disability spells end with recovery, underscoring the importance of rehabilitation and workplace accommodation.

1. Introduction

A nation's economic well-being depends on the health of its population. When people leave work due to health limitations, employers lose their knowledge, skills, and experience, losses that are becoming increasingly important as our population ages (Buchmueller & Valletta, 2017; Pransky et al., 2016). People who become unemployed due to disabilities often lose not only income, but also confidence, prestige, and social capital, making it more difficult for them to become re-employed (Berchick, Gallo, Maralani, & Kasl, 2012; Kalousova & Burgard, 2014). Even after recovery from work disability, lifetime opportunity for career advancement and increasing income may be reduced permanently (Breslin et al., 2007). Thus, limitations in the ability to work due to disabling physical, emotional, or mental conditions have important consequences for individuals and society.

Workforce aging in the United States has prompted growing interest in work disability (Buchmueller & Valletta, 2017; Jette & Badley, 2000;

Mathiowetz, 2000; Pransky et al., 2016). By 2020 more than one-quarter of the United States workforce will be age 55 or older (Toossi, 2012). Chronic health conditions associated with functional impairments that can limit work, particularly diabetes and obesity, have become increasingly prevalent at all adult ages (Buchmueller & Valletta, 2017; Martin, Freedman, Schoeni, & Andreski, 2010; Pransky et al., 2016). More than 40% of working age adults have at least one chronic condition (Buchmueller & Valletta, 2017; Ward, 2015); over 20% have two or more. These chronic conditions increase the risks of having functional limitations and work disability (Buchmueller & Valletta, 2017; Clarke & Latham, 2014; J.N. Laditka & Laditka, 2016c; Pransky et al., 2016; Ward, 2015). Nearly 55% of adults in the United States reported having a work disability at least once from age 25 to 60; about one-quarter reported having a severe work disability at least once at those ages (Rank & Hirschl, 2014). From 2000 to 2010, there was a large increase in participation in the Social Security Disability Insurance (SSDI) program for people with permanent work disability,

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followed by slower growth through 2015 (Buchmueller & Valletta, 2017), possibly associated with increased use of prescription pain medication (Case & Deaton, 2015).

Workplace accommodations, medical care, and other developments may help to limit work disability. The Rehabilitation Act of 1973 and state laws increased accommodations for employees with disabilities during the 1970s and 1980s. The 1990 Americans with Disabilities Act (ADA) and the ADA Amendments Act of 2008 addressed discrimination affecting a broad range of workers with disabilities, although some researchers suggest that the effects were modest (Burkhauser, Schmelter, & Weathers, 2011). Over the last several decades, increased access to health care and improved treatment of high blood pressure and heart disease may have reduced work disability (Sommers, Maylone, Blendon, Orav, & Epstein, 2017). Assistive devices improved during that period, and more people with functional impairments used them (Agree, 2014; Freedman, Kasper, & Spillman, 2017). These changes may help more Americans to work despite functional limitations that often accompany aging and chronic diseases. Notwithstanding these positive trends many Americans have work disabilities.

Work disability may affect some population groups more than others. African Americans have more chronic disease and functional impairment than non-Hispanic whites (hereafter whites), and a higher percentage of life with disability (Geronimus, Bound, Waidmann, Colen, & Steffick, 2001; Hayward & Heron, 1999; J.N. Laditka & Laditka, 2014; S.B. Laditka & Laditka, 2009, 2014, 2015; Levine & Crimmins, 2014; Sautter, Thomas, Dupre, & George, 2012). Studies suggest that although Hispanics live longer than whites they have more functional impairment (Angel, Angel, & Hill, 2014; Hayward, Hummer, Chiu, González-González, & Wong, 2014; Hummer & Hayward, 2015). Higher disability rates among Hispanics may be due to limited education, which is associated with less occupational opportunity and with high risk work such as meat processing, construction, cleaning, and domestic service (Hummer & Hayward, 2015), and also to lifetime effects of childhood adversity, which may be more common among Hispanics than among African Americans or whites (J.N. Laditka & Laditka, 2017). The work force in the United States is increasingly ethnically diverse: by 2024, 20% will be Hispanic (Buchmueller & Valletta, 2017). On average, Hispanics have more obesity, high blood pressure, and diabetes than non-Hispanic whites, and therefore greater risks of functional impairment (Buchmueller & Valletta, 2017). Little is known about whether health disparities affecting African Americans and Hispanics extend to work disability.

1.1. Work disability – a conceptual framework

The Social Security disability program defines work disability as a “medical condition [that] must significantly limit your ability to do basic work activities — such as lifting, standing, walking, sitting, and remembering — for at least 12 months” (Social Security Administration, 2017). More broadly, work disability is often defined by self-reports of physical, emotional, or mental conditions that make it impossible to work, or limit the type or amount of work a person can do (Burkhauser, Daly, Houtenville, & Nargis, 2002; Clarke & Latham, 2014; Jette & Badley, 2000). Consistent with definitions of disability by Nagi (1991) and the World Health Organization’s International Classification of Functioning, Disability and Health (ICF) (WHO, 2017), Jette and Badley (2000) describe a theory of work disability emphasizing limitations in performing socially defined roles and tasks, where disability and the ability to work cannot be determined solely by a diagnosis or an assessment of physical functioning. Factors linked to work disability include job characteristics that contribute to declining functioning and health or promote an individual’s ability to perform required tasks, physical factors of the environment such as climate, terrain, or building design, and perceptions of the social context of work and the degree to which that context limits work for individuals with physical, emotional, or mental limitations (Jette & Badley, 2000;

Pransky et al., 2016; WHO, 2017). Thus, of any two individuals with similar functional limitations, one may experience and report a severe work disability while the other reports a moderate work disability, or no work disability, due to differing perceptions or contexts including perceptions about the adequacy of workplace accommodations. Work disability is a useful summary indicator that assesses not only physical, emotional, or mental barriers to work but also the degree to which the workplace accommodates health limitations. Thus, work disability is more closely aligned with the ICF than measures that have been used more commonly to study disability, such as impairment in activities of daily living.

1.2. Study contributions and hypotheses

Given the importance of work disability for individuals and families, employers, governments, and society it is useful to better understand the dynamics of work disability. From the perspective of rehabilitation, it is useful to estimate recovery from work disability. We studied work disability from ages 20 through 65 using more than 45 years of data from a nationally representative sample. We estimated the prevalence of work disability at all adult working ages and the dynamics of recovery from work disability.

No research has focused on work disability among African Americans or Hispanics. Given the evidence of greater functional impairment among these populations (e.g., Hayward & Heron, 1999; Hummer & Hayward, 2015), we hypothesized that African Americans and Hispanics would have more moderate and severe work disability than whites.

It is well established that women have more functional impairment than men (e.g., S.B. Laditka & Laditka, 2009). Although little research has examined whether that pattern applies to work disability, we hypothesized that women would have more moderate and severe work disability than men.

Our analysis is the first to examine temporal trends in work disability by sex and race/ethnicity. Given the intended broad impact of the ADA and related laws, improvements in medical care and pharmaceutical treatments, and increased use of assistive devices, we hypothesized that work disability declined over the last quarter-century.

2. Materials and methods

2.1. Data source and study sample

We used data from the Panel Study of Income Dynamics (PSID), the longest-running household panel survey in the world. The PSID interviewed participants annually from 1968 through 1997, and every two years since then. The study maintains national representativeness by continuously following children, ex-spouses, and other adults of sampled households who form new households (Fitzgerald, 2011; McGonagle, Schoeni, Sastry, & Freedman, 2013). Co-residents of new households are included. Response rates were 76% and 88.5% in 1968 and 1969, respectively, and have ranged from 96% to 98% since then (Schoeni, Stafford, McGonagle, & Andreski, 2013).

We followed adults through 39 survey waves, from 1968 through 2015. Across all waves the PSID included 40,295 individuals who were designated as household heads or their spouses or partners in at least one wave. By the convention established in 1968, men were in most cases designated as the household heads when present. Our analysis focuses on those household heads and their spouses or partners. We excluded those who did not report work disability status in at least two survey waves ($n = 7795$), resulting in a sample of $n = 32,500$; 85.1% of participants excluded for this reason had longitudinal sampling weight values of zero. We also excluded 1937 participants who reported race or ethnicity other than African American, Hispanic, or white due to their few deaths, which are needed to estimate the models for this research, resulting in a final analytic sample of $n = 30,563$. Participants

included were nationally representative of African American, Hispanic, and white adults living in the community, with the exception that the Hispanic sample did not consistently represent immigrants throughout the study period.

2.2. Dependent variable – measuring work disability and death

Beginning in 1968 the PSID asked participants who identified themselves as household heads, “Do you have any physical or nervous condition that limits the type of work or the amount of work you can do?” Next, the PSID asked those who responded “yes,” “Does this condition keep you from doing some types of work?” Participants could respond: “yes,” “no,” or “can do nothing.” We considered participants who responded that they could “do nothing” to have a severe work disability. If participants responded “yes,” the PSID asked how much the condition limited the amount of work they could do. Response options were: “a lot,” “somewhat,” “just a little,” or “not at all.” We considered participants who responded “a lot” to have a severe work disability, and those who responded “somewhat” to have a moderate work disability. In 1969–1971 the questions did not measure severity; we excluded those years. In some years before 1980 the PSID asked only new participants about work disability. We used their responses, excluding data that the PSID carried forward from previous waves for other participants. In 1978 and all waves starting with 1981, the PSID asked the same work disability questions about the household head’s spouse or partner; we used all of those measures. We also used data for this measure from 1976 and 1985, when the PSID asked spouses or partners these questions directly.

We examined whether reports of work disability for women differed depending on whether the household head or a spouse/partner provided the report, using the 1976 and 1985 responses from spouses or partners. We used logistic regression to compare the likelihood that a spouse or partner would herself report work disability to the likelihood that a household head would report disability for her in the preceding or following year. We also examined longitudinal transitions into and out of household head status, and compared the likelihood that a household head would report having a work disability, versus a report of work disability by or for a spouse or partner. In another area, we used discrete-time hazard analysis to examine whether work disability was associated with missing data in a later wave due to attrition.

Information on deaths was from the National Death Index, compiled by the National Center for Health Statistics (NCHS) from state vital records. The Index includes information about participants who were lost to follow-up, providing a comprehensive record of all deaths.

2.3. Controls for other characteristics

The model represented increasing risks of work disability and death with increasing age, and an accelerating rate of that increase, including covariates for age in years and age-squared. We controlled for education levels: less than high school graduation, high school graduation or receipt of the General Educational Development credential, or post-secondary education. We controlled for sex and included dummy variables representing African Americans and Hispanics, with whites as the reference category due to the relatively large size of that population group.

2.4. The model relating the measured characteristics to work disability

We estimated the probabilities of work disability status transitions with a multinomial logistic Markov model estimated by maximum likelihood, an approach that can accommodate any pattern of unrecorded transitions between interviews as well as varying durations of time between interviews; this model is well-established for use in such research (Crimmins, Hayward, Hagedorn, Saito, & Brouard, 2009; J.N. Laditka & Laditka, 2014; 2016a, 2016b, 2016c; 2017; S.B. Laditka,

1998; S.B. Laditka & Laditka, 2014, 2015, 2017; S.B. Laditka & Wolf, 1998; Saito, Robine, & Crimmins, 2014). In addition to death the transition types included transitions from and to: not work disabled, moderately work disabled, or severely work disabled. We included interaction terms in the model to provide transition probabilities that were specific to groups defined by sex and race/ethnicity.

2.5. Microsimulations

We used the probabilities estimated by the Markov models to conduct dynamic microsimulations, creating large simulated populations of individuals, each with a complete annual history of moderate or severe work disability through death. Details of this method are published (S.B. Laditka, 1998; S.B. Laditka & Hayward, 2003; S.B. Laditka & Laditka, 2009, 2014; S.B. Laditka & Wolf, 1998). Each individual began the simulation at age 20. In each year, the individual was not work disabled, moderately work disabled, or severely work disabled. Based on the probabilities, which for any given year of life were conditional on the individual’s current work disability status, age, sex, education, and race or ethnicity, in the next year the individual could be: not work disabled, moderately work disabled, severely work disabled, or dead. In a microsimulation for each population, such as Hispanic women, we created 100,000 lives, each with an annual work disability status from age 20 through death. Simulating 1 million did not change results meaningfully. We then measured the total years with each level of work disability for each individual, and averaged the totals across the population. For both moderate and severe work disability we calculated the population prevalence at each age, the average number of spells at ages 20–65, and several measures of recovery.

To examine temporal trends in work disability, we estimated a model with dummy variables indicating analytic observations beginning in the years 1968–1990, 1991–2004, and 2005–2015; these time periods represent periods before and after the ADA, and the most recent decade represented in the data, respectively. This model provided separate estimates by sex and race/ethnicity. To examine whether evidence of a trend in work disability was sensitive to the number, length, or cut points of the time periods studied, we estimated a final model that represented every two year period beginning with 1987, each identified with a separate dummy variable. The reference period for that analysis was 1968–1986; a limited number of deaths in the relatively young sample during the early years of the PSID did not permit further division of the reference period. To ensure adequate statistical power we estimated this model adjusting for age in years, without regard to sex or race/ethnicity.

2.5.1. Variance estimation for microsimulation results

We used bootstrapping to estimate variation in the microsimulation results, accounting for parameter uncertainty and Monte Carlo variation. Bootstrapping repeated the microsimulation for each population 1000 times; additional iterations did not change results at the reported level of precision. For each repetition we randomly selected each parameter from its 95% confidence interval (CI). We report the means of the repetition results. We created the software used to estimate the Markov models and conduct the microsimulations using SAS IML (Cary, North Carolina). The Institutional Review Board (IRB) at [blinded for review] determined that this research did not require IRB review.

3. Results

3.1. Characteristics of the sample

Table 1 describes the sample. There were 429,757 work disability status transitions and 2548 deaths. The data represented 638,865 person-years. Participants’ average age was 40.8 (standard deviation, SD 16.0) when they began reporting work disability, and 49.2 (SD 19.1) when they provided their final work disability information or died

Table 1
Work disability, characteristics of the sample^a.

	Women			Men		
	African American	Hispanic	White	African American	Hispanic	White
Sample size (unweighted)	5147	3216	7597	4410	2646	7547
Sample distribution (weighted %)	7.7	6.7	38.8	5.8	4.6	36.3
Age at first disability measurement (weighted mean)	38.3	42.0	45.5	36.8	37.7	37.3
Age at last disability measurement (weighted mean)	49.6	46.8	58.7	45.5	42.0	47.5
Educational attainment, years (weighted mean)	12.9	11.8	13.8	12.8	11.3	13.9
Measured work disability and death transitions	75,691	23,167	124,726	55,001	17,906	133,266
Person years of measured disability status	114,919	34,284	194,396	78,736	25,730	190,800
Deaths, n	438	50	758	422	75	805

^a Data source: Panel Study of Income Dynamics, 1968–2015, n=30,563, disability refers to work disability.

(results not shown).

3.1.1. Sensitivity of results to reporting by household head or spouse/partner

In results not reported in a table, 51.2% of the analytic observations represented women. Among household heads who reported their own work disability status, the percentages who were women in the 1970s, 1980s, 1990s, 2000s, and 2010s were, respectively: 28.3%, 29.3%, 30.1%, 29.8%, and 32.2%. There was a statistically significant difference in the likelihood that a spouse or partner would herself report work disability, compared with a household head's report of her disability status in the preceding or following year ($p < 0.001$). However, the odds ratio comparing these likelihoods (odds ratio, OR 1.01) indicated little or no meaningful difference.

Due to divorce, separation, or death, over time individuals may change status as household heads or spouses/partners, although in all such instances other than death the PSID continues to follow those who form new households. In our analytic data 15.8% of participants changed status between those categories, among whom the average number of changes was 6.8 across the 48 years (standard deviation, SD 6.2). Across all years represented in the analytic data, the odds that a household head would report work disability were only slightly larger than the odds that a work disability would be reported either by or for a

spouse or partner (OR 1.04; 95% confidence interval, CI 1.03–1.08).

3.1.2. Missing data

Between the baseline and final wave for each participant (excluding death) the average participant had missing data in 0.52 waves (SD 1.36), compared with non-missing responses in 14.1 waves. Thus, the Markov model adjusted the transition probabilities for missing data for $[(0.52/14.1) \times 100] = 3.7\%$ of all transitions. The average number of waves with missing data between a participant's final responses and death was 0.08 (SD 0.28). In the results of the discrete-time hazard analysis that predicted missing data, participants reporting work disability in a given wave had 21% lower odds than others of having missing data in the next wave (OR 0.79, CI 0.73–0.86.7).

3.2. Work disability, ages 20 through 65

Life expectancies for the microsimulated populations were similar to those calculated by the NCHS for African American, Hispanic, and white women and men; their 95% confidence intervals included the NCHS estimates (results not shown in a table).

Tables 2 and 3 show the microsimulation results for women and men. In the results for women (Tables 2), 44.5% of Hispanics had at least one spell of moderate work disability at ages 20–65; 24.4% had at

Table 2
Work disability in the united states ages 20–65, women.^a.

	African American		Hispanic		White	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
% ever work disabled, ages 20–65	54.8 ⁺ (53.8–56.1)	40.7 ⁺ (39.3–42.3)	44.5 ⁺ (43.2–46.0)	24.4 ⁺ (23.1–25.8)	76.7 (75.5–77.8)	47.3 (46.0–48.7)
% of population age 50	7.2 ⁺ (6.9–7.6)	5.8 ⁺ (5.4–6.1)	5.8 ⁺ (5.3–6.3)	3.8 ⁺ (3.5–4.1)	9.8 (9.4–10.2)	6.4 (6.1–6.7)
% of population age 65	10.1 ⁺ (9.6–10.6)	11.8 ⁺ (11.0–12.3)	8.1 ⁺ (7.5–9.1)	8.0 ⁺ (7.5–8.6)	13.7 (13.2–14.3)	13.7 (12.9–14.4)
% of years ages 20–65	7.0 ⁺ (6.7–7.3)	6.0 ⁺ (5.6–6.3)	5.9 ⁺ (5.4–6.5)	4.6 ⁺ (4.0–5.1)	8.8 (8.5–9.1)	8.3 (8.0–8.6)
Spells, ages 20–65, n (mean)	0.8 ⁺ (0.7–0.9)	0.5 (0.4–0.6)	0.6 (0.5–0.7)	0.3 ⁺ (0.2–0.4)	1.4 (1.3–1.5)	0.6 (0.5–0.7)
Recovery transitions:						
% moderate spells with recovery	64.7 ⁺ (62.4–66.5)		67.1 (65.3–70.2)		69.6 (68.1–70.9)	
% severe spells with recovery to not disabled		40.8 ⁺ (38.5–43.2)		39.4 ⁺ (36.5–42.0)		34.0 (31.8–36.0)
% severe spells with recovery to moderate		30.4 ⁺ (28.3–32.5)		27.6 ⁺ (24.9–29.3)		40.7 (38.8–42.5)

comparing results for African Americans and Hispanics to those for non-Hispanic whites.

^a Data source, Panel Study of Income Dynamics, 1968–2015; results of multinomial logistic Markov models and dynamic microsimulation; parentheses show 95% confidence intervals.

⁺ $p < 0.05$.

^{*} $p < 0.01$.

Table 3
Work disability in the United States, ages 20–65, men.^a

	African American		Hispanic		White	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
% ever work disabled, ages 20–65	57.7 [*] (56.7–58.7)	57.0 [*] (55.2–58.9)	65.9 [*] (63.8–67.4)	52.0 [*] (49.9–53.9)	62.0 (61.1–62.8)	43.1 (41.8–44.1)
% of population age 50	5.0 [*] (4.8–5.2)	8.7 [*] (8.2–9.0)	4.9 [*] (4.7–5.2)	6.3 (5.8–6.7)	6.0 (5.8–6.2)	6.0 (5.7–6.3)
% of population age 65	6.8 [*] (6.5–7.1)	17.5 [*] (16.7–18.4)	6.9 [*] (6.4–7.4)	13.2 (12.1–14.1)	8.5 (8.3–8.8)	12.8 (12.2–13.4)
% of years ages 20–65	4.6 [*] (4.4–4.8)	4.3 [*] (4.1–4.5)	4.4 [*] (4.2–4.7)	4.1 [*] (3.8–4.4)	5.6 (5.4–5.7)	5.1 (4.9–5.2)
Spells, ages 20–65, n (mean)	0.9 (0.7–1.0)	0.8 [*] (0.7–0.9)	1.1 (1.0–1.2)	0.7 ⁺ (0.6–0.8)	1.0 (0.9–1.1)	0.5 (0.4–0.6)
Recovery transitions:						
% moderate spells with recovery	68.8 [*] (67.3–70.7)		74.9 (65.3–70.2)		70.8 (69.7–72.0)	
% severe spells with recovery to not disabled		47.6 [*] (46.0–49.4)		50.0 [*] (47.4–52.9)		40.9 (39.7–42.2)
% severe spells with recovery to moderate		25.2 [*] (23.2–26.8)		28.2 (25.9–30.6)		31.3 (29.7–32.7)

comparing results for African Americans and Hispanics to those for non-Hispanic whites.

^a Data source, Panel Study of Income Dynamics, 1968–2015; results of multinomial logistic Markov models and dynamic microsimulation; parentheses show 95% confidence intervals.

⁺ $p < 0.05$.

^{*} $p < 0.01$.

least one spell of severe work disability; analogous results for whites were 76.7% and 47.3% (both $p < 0.01$). Fewer African Americans than whites reported a moderate or severe work disability, respectively 54.8% and 40.7% (both $p < 0.01$). Compared with whites, African Americans and Hispanics had a lower percentage of years with a work disability at ages 20–65 (all $p < 0.01$); for example, Hispanic women had moderate work disability for 5.9% of those typical working years compared to 8.8% for white women ($p < 0.01$); the comparable results for severe work disability were, respectively, 4.6% and 8.3% ($p < 0.01$).

In results for recovery, African Americans recovered from a lower percentage of moderate spells than whites (64.7% compared with 69.6%, $p < 0.01$). Higher percentages of severe work disability spells ended with recovery to not work disabled for both Hispanics and African Americans than for whites (39.4% and 40.8%, respectively, versus 34.0%, both $p < 0.01$). However, both Hispanics and African Americans had a lower percentage of recovery from severe to moderate spells than whites (respectively 27.6% and 30.4%, versus 34.0%, both $p < 0.01$). The majority of moderate spells ended with recovery; the majority of severe spells ended with recovery to either not disabled or moderately disabled.

In results for men (Table 3) 65.9% of Hispanic men had one or more spells of moderate work disability at ages 20–65; 52.0% had one or more spells of severe work disability; analogous results for whites were 62.0% and 43.1% (both $p < 0.01$). Thus, in contrast to the results for women, Hispanic men reported significantly more work disability than white men. Compared to whites, African Americans were less likely to report moderate work disability, 57.7% versus 62.0%, but considerably more likely to report severe work disability, 57.0% versus 43.1% (both $p < 0.01$). The rate of severe work disability at age 65 was significantly greater for African American men (17.5%) than for Hispanic (13.2%) or white (12.8%) men (both $p < 0.01$). In results for recovery, African Americans recovered from severe work disability to not disabled at a higher rate than whites (47.6% compared with 40.9%, $p < 0.01$); however the rate of recovery from severe to moderate work disability was lower for African Americans than for whites (25.2% compared with 31.3%, $p < 0.01$). As in the results for women, the majority of work disability spells ended with recovery or reduced disability.

We compared the Table 2 results for women to the Table 3 results for men by examining the ratios of the results for women to those for men. Ratios greater than 1 indicate higher rates for women; ratios less than 1 indicate higher rates for men. For example, among African Americans, the ratio for ever having a severe work disability is $40.7 / 57.0 = 0.71$, indicating that among African Americans men were substantially more likely than women to have a severe work disability. Among African Americans and Hispanics, women were significantly less likely to report ever having a work disability; the ratios of their rates to those of men for moderate and severe work disability were, respectively, 0.95 and 0.71, 0.68 and 0.47 (not shown; all $p < 0.01$). Among whites, however, women were more likely to report both moderate and severe work disability, with rate ratios 1.24 and 1.10. African American and Hispanic men, especially, were more likely to recover from moderate work disability, or to transition from severe work disability to not disabled, than women in those groups (both $p < 0.01$). For African Americans and Hispanics, the dynamics of disability resulted in more moderate work disability for women at age 65, with respective rate ratios comparing women to men 1.49 and 1.17 (both $p < 0.01$). However, for the same groups women had considerably less severe work disability at age 65, with respective rate ratios 0.67 and 0.61 (both $p < 0.01$). Among whites, women were more likely to ever report a moderate or severe work disability, with respective rate ratios 1.24 and 1.10 (both $p < 0.01$), and to have both moderate and severe work disability at age 65, with respective rate ratios 1.61 and 1.07 (both $p < 0.01$).

3.3. Work disability trends

Results of the work disability trend analyses are shown in Table 4. The table shows the prevalence of moderate and severe work disability at age 65 and the percentage of years with moderate or severe work disability at ages 20–65, by sex and race/ethnicity, for 1968–1990, 1991–2004, and 2005–2015. The results for each sex and race/ethnicity group showed significant decreases in both measures over the study period. For example, for women, in 1968–1990, 12.3% and 13.9% of Hispanics had moderate and severe work disability at age 65, respectively; the analogous percentages were 10.7% and 9.1% in 1991–2004,

Table 4

Percent of population with work disability at age 65 and years at ages 20-65 with work disability, 1968-1990, 1991-2004, and 2005-2015.

	1968-1990		1991-2004		2005-2015	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
Women						
African American						
% at age 65	11.2 (10.6-11.8)	18.9 (17.8-20.0)	10.4 (9.6-11.0)	12.2 (11.4-13.1)	9.0 (8.4-9.5) [*]	11.0 (10.3-11.4) [*]
% ages 20-65	7.4 (7.0-7.8)	7.2 (6.8-7.5)	7.2 (6.8-7.6)	6.2 (5.8-6.7)	7.0 (6.7-7.4) [*]	5.5 (5.2-5.9) [*]
Hispanic						
% at age 65	12.3 (11.0-13.9)	13.9 (12.6-15.9)	10.7 (10.5-12.2)	9.1 (8.6-9.8)	9.2 (7.9-11.0) [*]	8.3 (7.4-9.4) [*]
% ages 20-65	8.1 (7.6-8.9)	7.6 (6.8-8.5)	7.3 (6.9-7.9)	6.1 (5.7-7.0)	6.7 (6.1-7.6) [*]	5.2 (4.1-6.4) [*]
White						
% at age 65	13.7 (13.1-14.3)	13.7 (13.0-14.3)	12.8 (12.2-13.5)	8.7 (8.2-9.1)	11.1 (10.5-11.8) [*]	7.5 (7.2-7.9) [*]
% ages 20-65	8.8 (8.4-9.2)	8.3 (8.0-8.7)	8.6 (8.1-8.9)	7.1 (6.7-7.5)	8.4 (8.0-8.7) [*]	6.2 (5.8-6.5) [*]
Men						
African American						
% at age 65	6.8 (6.4-7.1)	17.4 (16.7-18.4)	5.9 (5.5-6.3)	10.8 (10.2-11.6)	5.1 (4.7-5.4) [*]	9.6 (9.0-10.1) [*]
% ages 20-65	4.6 (4.4-4.7)	4.2 (4.0-4.5)	4.5 (4.3-4.7)	3.5 (3.3-3.8)	4.7 (4.5-4.9) [*]	3.2 (3.1-3.4) [*]
Hispanic						
% at age 65	6.9 (6.4-7.4)	13.1 (12.0-14.0)	5.8 (5.3-6.4)	8.3 (7.6-9.1)	4.8 (4.3-5.4) [*]	7.5 (6.8-8.1) [*]
% ages 20-65	4.4 (4.2-4.6)	4.1 (3.8-4.3)	4.0 (3.7-4.3)	3.1 (2.7-3.6)	3.9 (3.5-4.2) [*]	2.7 (2.3-3.1) [*]
White						
% at age 65	8.5 (8.2-8.9)	12.8 (12.1-13.4)	7.7 (7.3-8.1)	7.9 (7.4-8.4)	6.6 (6.2-6.9) [*]	6.9 (6.6-7.1) [*]
% ages 20-65	5.6 (5.4-5.8)	5.1 (4.9-5.2)	5.5 (5.3-5.7)	4.2 (3.9-4.4)	5.7 (5.5-6.0) [*]	3.7 (3.5-3.9) [*]

^aData source, Panel Study of Income Dynamics; results of multinomial logistic Markov models and dynamic microsimulation; % ages 20-65 = percent of life at those ages with moderate or severe work disability; parentheses show 95% confidence intervals.

* p-trend < 0.01.

9.2% and 8.3% in 2005-2015 ($p < 0.01$). The results for both women and men show particularly large reductions in severe work disability across the three time periods.

Fig. 1 shows work disability trends with estimates for each two-year period beginning with 1987-1988. The left panel shows the results with linear ordinary least squares (OLS) regression lines. The right panel shows the same data with nonlinear results. The prevalence of both moderate and severe work disability generally declined throughout the period studied. For every two years, moderate work disability declined about one-half percent, and severe work disability declined about 0.7 percent (R-squared respectively 0.84 and 0.76). The regressions shown in the right panel of Fig. 1 (R-squared respectively 0.91 and 0.87) suggest that the decline in rates of work disability may have slowed in recent years, although both figures indicate a substantial rate reduction over the entire period. Additional years of data are needed to determine which of the two regression approaches best depicts recent trends.

4. Discussion

Results showed that work disability is common, and were generally consistent with those from nationally representative data (Burkhauser et al., 2002; Clarke & Latham, 2014; Mathiowetz, 2000; Rank & Hirsch, 2014). Recovery from work disability was also common, and variation in recovery contributed substantially to differences in work disability histories among the groups we studied. No previous work disability research of which we are aware provided estimates of recovery.

For women, our results were not consistent with our first hypothesis. African American and Hispanic women reported less moderate and severe work disability than whites. Studying individuals' risks of a first occurrence of either any work disability or severe work disability, Rank and Hirsch (2014) found that nonwhites were less likely to report any work disability than whites, with no significant difference for severe work disability. That the latter finding differs from our result may be

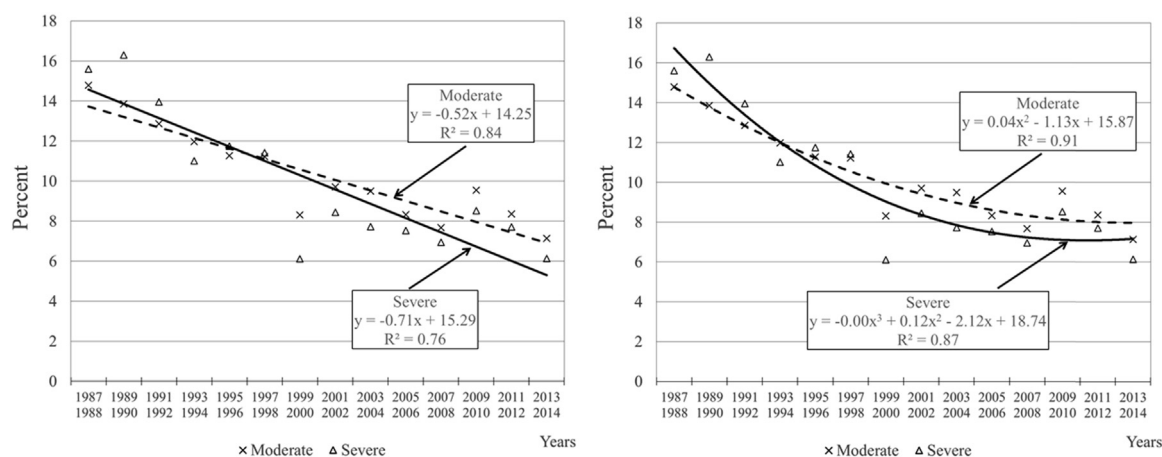


Fig. 1. Percent of population with moderate and severe work disability at age 65, by two-year periods. Data source: panel study of income dynamics, 1968-2015; results of multinomial logistic Markov models and dynamic microsimulation.

due to their focus on household heads, which limited the representation of women, or to differences in methods. Our finding of more work disability among white women than others is also not consistent with typical findings that African Americans (e.g., Hayward & Heron, 1999) and Hispanics (e.g., Angel et al., 2014; Hayward et al., 2014) have more functional impairment than whites. This result may be due to variation in work disability by socioeconomic status. On average, African Americans and Hispanics have fewer socioeconomic resources than whites. Individuals with limited resources may be more likely to continue working despite functional impairments, and less likely to report work disability. Limited resources may especially affect women who do not share household incomes and expenses with another adult, which is more common among African American and Hispanic women than among white women (e.g., Hummer & Hayward, 2015; Levine & Crimmins, 2014).

Results for men were partially consistent with our first hypothesis, and suggested a more complex dynamic of work disability. African American men became severely work disabled more often than whites. African Americans also recovered from severe spells more often than whites and had shorter severe spells. However, the combined effect of these dynamics for African American men was more severe work disability at age 65.

Consistent with the results for African American men, Hispanic men were more likely than white men to have at least one spell of severe work disability during working life, which may be related to Hispanics' greater exposures to high risk work and greater risks of occupational injury or illness (Hummer & Hayward, 2015). However, Hispanic men had a lower percentage of years with work disability than white men. As with African American men, this result is due to the substantially higher rate of recovery from severe work disability for Hispanic men than for white men. Unlike the result for African American men, however, these dynamics did not result in more work disability at age 65 for Hispanic men.

Cultural differences among the groups we studied may affect reporting of work disability. Knowledge and beliefs about disability and perceptions of stigma and discrimination associated with disability may vary by race/ethnicity. Similarly, variation by race/ethnicity in expectations and perceptions of work could affect responses about work disability. We are not aware of any research that has addressed these topics.

Consistent with our hypothesis regarding variation in work disability by sex, white women were more likely than white men to ever report having either a moderate or severe work disability, and to have both moderate and severe work disability at age 65. African American and Hispanic women had more moderate work disability at age 65 than men; however, substantially more African American and Hispanic men had severe work disability at age 65 than women.

Our study provided a first look at work disability trends by sex and race/ethnicity. We found that work disability declined significantly across the study period for African American, Hispanic, and white women and men, consistent with our third hypothesis, with a particularly large decline in severe work disability. A final analysis that estimated the prevalence of work disability in each two-year period beginning with 1987–1988 also suggested that work disability declined throughout that period. That result is consistent with potential combined effects of many factors including: greater workplace accommodation related to the ADA and other anti-discrimination laws; increased use of assistive devices (Agree, 2014; Freedman et al. 2017); better medical care and pharmaceutical control of chronic conditions, particularly high blood pressure and heart disease; and greater access to primary care (Sommers et al., 2017). It is also possible that expectations about work and disability may have changed across the study period in ways that reduced reporting of work disability.

4.1. Limitations and strengths

Participants self-reported work disabilities and their levels, which may be subject to measurement error (e.g., Burkhauser et al., 2002; Mathiowetz, 2000). However, work disability is not limited to objectively measured functional limitations (Jette & Badley, 2000; Pransky et al., 2016; WHO, 2017). Aside from situations where the determination of work disability requires objectively measured functional limitations to qualify for a government transfer payment or disability insurance benefits, if an individual reports a health limitation that makes it difficult or impossible to work it may be reasonable to accept that judgment. The individual's belief may reflect barriers to work associated with a health condition or the built environment, or with the perceptions and reactions of employers, coworkers, or family (Pransky et al., 2016).

Regarding Hispanics, the PSID sample included 2,043 families from Mexico, Puerto Rico, and Cuba from 1990 through 1995, as well as other Hispanics throughout the PSID's history (McGonagle, et al., 2013). Thus, the data for Hispanics represented both immigrants and those born in the United States. However, due to limited data the results for Hispanics may not represent the dynamics of work disability among Hispanic immigrants.

Attrition may have biased the model showing declining work disability over time. Attrition may be greater for those in poor health, resulting in increasingly better average health among continuing respondents over time. However, several studies found that attrition was not associated with health status in the PSID (see for example, Fitzgerald, 2011). In our analysis, participants reporting work disability in a given wave had significantly lower odds than others of having missing data due to attrition in the next wave, suggesting that the decline in work disability that we observed over time may be estimated conservatively.

Strengths of our study include the many measurements of work disability across a long span of years. The PSID used the National Death Index to identify deaths for all participants, including those lost to follow-up. The large PSID sample enabled us to estimate work disability rates and durations as well as the dynamics of recovery for African Americans, Hispanics, and whites, and for women and men. The trend analysis provided information about work disability that has not been previously reported.

4.2. Implications for rehabilitation, employer accommodation, and research

Of particular interest from the perspective of rehabilitation, individuals in all groups who became work disabled often recovered to moderate disability or not disabled. Many conditions associated with work disability are episodic, with common trajectories of increasing impairment and recovery (Jette & Badley, 2000). Employers should recognize that many employees work with disabilities and that recovery is common. Studies have shown the effectiveness of self-determined accommodations, work flexibility, and consistent support from managers (Pransky et al., 2016). Employers need to emphasize work retention, sustainability, career development and progression, and injury prevention and recovery (Buchmueller & Valletta, 2017; Pransky et al., 2016). Work disability prevention strategies should address workplace climate, attitudes, and responses (Pransky et al., 2016). Given our aging and increasingly diverse workforce, and the increasing number of employees with functional limitations and multiple chronic health conditions, employers may increasingly recognize the need for workplace accommodations.

The results of this study also suggest the usefulness of additional research on work disability. More research is needed on strategies to address limitations associated with specific and multiple chronic conditions. Especially needed is research to better understand differences between declining individual-level work disability and participation in the SSDI program (Buchmueller & Valletta, 2017). Those differences

may indicate that a relatively small yet growing proportion of individuals with the most serious work disabilities qualify for SSDI, while among all other adults work disability is declining although still common. Also useful would be research to examine: knowledge and beliefs about work disability in groups defined by sex, race and ethnicity, age, and socioeconomic status; and perceptions of barriers to work associated with functional impairments or health limitations including employer practices, terrain and the design of buildings, work spaces and tools, and discrimination and stigma.

Disclosure

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Ethics approval statement

The Institutional Review Board (IRB) at the University of North Carolina at Charlotte determined that this research did not require IRB review.

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